

The Fipronil Affair, Pesticides in Eggs - Why It Happened and Can It Be Prevented from Happening Again

A. Pavlicevic¹, JongUng Yoon², I.Pavlović³

¹("AVES MIT" LLC, "Dermanyssus gallinae" Cluster, Subotica-Bajmok, Serbia)

²(Biogenoci Co., Ltd., Suwon, Republic of Korea)

³(Scientific Veterinary Institute of Serbia, Belgrade, Serbia)

ABSTRACT : Most poultry productions in the world have a health problem with an external parasite, the red poultry mite - *Dermanyssus gallinae* in their flocks. In the past few days there has been an international affair with Fipronil application for the red poultry mite control, where residue harmful to consumers' health appeared in eggs. Is this a separate case, or just a glimpse of the big picture showing uncritical red poultry mite control? Control program for the red poultry mite lists and defines all important factors for *D. gallinae* control. Firstly, it provides full safety of the control, excluding all harmful residues in eggs, especially physiologically active synthetic chemical compounds with acaricide effect. The program focuses on preventive veterinary medicine. Its main principle is the choice of products and methods based on the previous comparative testing and checking. This is followed by adequate preparation of housing facilities, professional application of products and methods as well as the implementation of auxiliary measures and constant supervision. Only in this way we can expect a certain effect and rational control of the red poultry mite..

KEYWORDS: poultry red mite, rational control, fipronile

I. INTRODUCTION

Most poultry productions in the world have a health problem with an external parasite, the red poultry mite - *Dermanyssus gallinae* [1] in their flocks. Red poultry mites feed on the blood of birds and mammals. They stay on the host only while feeding, whereas they spend the rest of the time in the environment, especially in hidden spots. They multiply fast and can reach the number of several tens or even hundreds of thousands per one hen [2]. They cause specific clinical signs, disturbance in the flock, and pale combs. Combs lack blood, which now gives color to the mass of mites which cover the environment. Further signs include health problems in the flock, increased mortality, drop in production results and, eventually, economic loss of the production. However, the most important consequences are the toxicological ones.

Fig 1. A detail of clinical signs in a layer hen infested by the red poultry mite.



II. THE PROBLEM

In the past few days there has been an international affair with Fipronil application for the red poultry mite control, where residue harmful to consumers' health appeared in eggs [3]. Is this a separate case, or just a glimpse of the big picture showing uncritical red poultry mite control? It is common knowledge that synthetic chemical compounds for mite and insect control - pesticides are a dominant type of red poultry mite control in poultry industry [4,5,6]. A question arises instantly – whether residue monitoring has been efficient enough over the past thirty years, given that so far it has not indicated any serious toxicological problems in eggs. Have all hazardous substances that can be abused in poultry production been controlled? Certainly, if something is not searched, it cannot be found. Does the egg sampling methodology itself provide safety for consumers? A lot of data on safety is missing, and available testing and clinical practice provide reasons for concern [5,7,8,9,10]. HACCP system in poultry industry does not even process the toxicological risk arising from uncritical control of

D. gallinae [9]. Basic characteristics of red poultry mite control in practice are:

1. Taking into consideration the general situation of poultry industry worldwide, the prevalence of red poultry mite, the harm it does,
2. and all kinds of expenditures for the productions, we come to a general conclusion that the red poultry mite is not controlled efficiently
3. or cost-effectively enough.
4. Scientific community has not yet made sufficient contribution to the clinical practice of D. gallinae control.
5. Veterinary medicine has been absent from the problem, so ,for the most part, the red poultry mite control has been implemented
6. incompetently and it has essentially come down to product trade and , mostly incompetent product application. There are very few
7. examples of a comprehensive approach to control in practice.
8. The market often offers inefficient products for control, which additionally exacerbates the situation.
9. There are few professional services for D.gallinae control, and their quality is questionable.
10. Egg producers are usually forced to get by and look for solutions on their own because veterinary medicine has not provided any for
11. them.
12. The current D. gallinae control focuses on curative treatments. In addition to that, there are frequent unattended situations.
13. There is no useful quality data available for professionals either, so they are bound to make all sorts of mistakes.
14. The application of synthetic chemical compounds with acaricide effect are favored because of their price and, until recently efficacy.
15. Fortunately, pesticides are inevitably excluded due to red poultry mites' resistance.
16. This situation leads to a misconception that the red poultry mite problem cannot be solved, and therefore only suppressive effects
17. are offered - the decrease in number of D. gallinae. Thus, poultry producers are caught in a vicious circle of constant problems and
18. expenditures. Contrary to the common opinion, we claim that the red poultry mite problem can be solved and should not exist in poultry
19. industry.

THE SOLUTION – CONTROL PROGRAM OF THE RED POULTRY MITE: Control program for the red poultry mite lists and defines all important factors for D. gallinae control. Firstly, it provides full safety of the control, excluding all harmful residues in eggs, especially physiologically active synthetic chemical compounds with acaricide effect. The program focuses on preventive veterinary medicine. Its main principle is the choice of products and methods based on the previous comparative testing and checking. This is followed by adequate preparation of housing facilities, professional application of products and methods as well as the implementation of auxiliary measures and constant supervision. Only in this way we can expect a certain effect and rational control of the red poultry mite. The primary objective of the program is highly efficient suppression. The final objective is the solution of the problem - eradication of the red poultry mite from production facilities and introduction of biosecurity measures. We will practically prove the possibility of D. gallinae eradication. We have been developing the red poultry mite control program in Serbia since 2000 [11]. It is now an international plan which has completed a number of development tasks: methodology of laboratory (P 441/01) and clinical testing; comparative testing of the most important products and methods [12]; testing of resistance development

[13]; detection and supervision [14,15,16]; suggestion for the improvement of forensic assessment [17]; suggestion for innovative improvements of cages and equipment and concept for control in extensive poultry production (P 2017/ 0762); innovative improvement of silicate application by combining powder and liquid forms; designing an original oil-based formula for mechanical control (P 547/17); professional machine application of powder and liquid formulations; suggestion for the improvement of residue monitoring ; suggestion for integrated health care [12]; presenting biological features of *D. gallinae* relevant to control [18,19,20];informing poultry producers [21,22,23].

The program is now based on the control which uses products and methods with mechanical effect in the interest of providing the maximum safety level.

1. Detailed combined application of the chosen liquid and powder silicates in the preparation of housing facilities together with sufficient housing downtime in the temperature conditions which enables red poultry mite activity lead to *D. gallinae* eradication from the facilities.

Fig.2. Cages with a protective silicate layer, combined application of powder DE and liquid silicate, *D. gallinae* Cluster, Serbia.

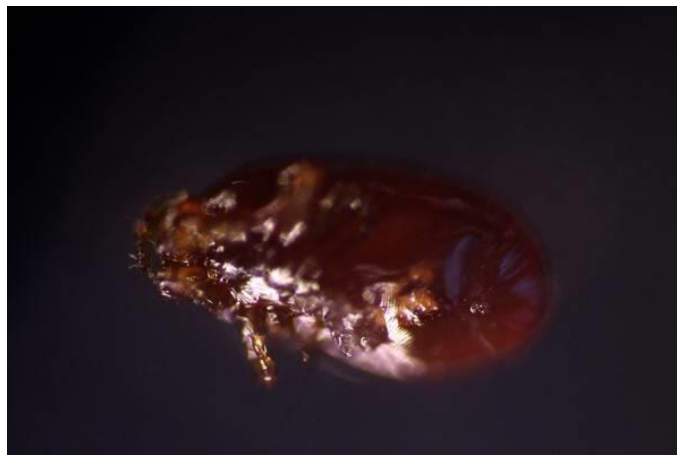


2. A new oil-based product which prevents the red poultry mite's respiration is being prepared for registration. It is efficient on directly exposed mites. In addition to that, a layer with a long-term extended effect is formed on nonabsorbent surfaces.

Fig 3. Cages with a protective oil layer, D. gallinae Cluster, Serbia.



Fig.4. Effect of the oil-based formulation on D. gallinae.



The program is always open for any new improvement of D. gallinae control which can justify its application instead of the existing selection of products and methods with a higher safety level, efficacy or cost-effectiveness.

For the promotion of control program, we recommend the following:

III. VETERINARY MEDICINE NEEDS TO:

1. Improve the education of professional staff;
2. Adequately inform poultry producers;
3. Provide recommendations useful for technology of poultry production ;
4. Perform the standardization of laboratory and clinical testing of biological efficacy of products and methods;
5. Perform the triage of infested and uninfested farms and regularly monitor and provide feedback on the spreading of infestation (prevalence);
6. Promote the implementation of biosecurity measures in uninfested farms;
7. Improve forensic assessment;
8. Insist on the importance of poultry housing preparation and on preventive medicine;
9. Provide information which enables a safe, efficient and rational control based on comparative testing of products and methods;
10. Implement professional control or provide information that enables professional control implementation;

11. Promote integrated health care. Examples: -infectious diseases. Coordinate programs, use the housing downtime to eradicate *D. gallinae* vectors. It is essential to integrate all preventive measures. -toxicology, for example the current case with Fipronil. Use the housing downtime to eradicate *D. gallinae* on poultry farms and in this way help to overcome the situation. -use the change of technology (such as the cage system in the EU) as an especially beneficial opportunity for *D. gallinae* control if that possibility is accepted and correctly planned.

12. Improve residue monitoring. Random samples can be complemented with targeted ones. First by detailed inspection and then by continuous monitoring, farms need to be classified into three groups:

- The ones without *D. gallinae*;
- The ones that can prove safe control (e.g. invoices); and
- The rest (infested facilities without proof of safe control). This group requires the greatest attention in the form of sample inspection, monitoring and control. In this way we can obtain the targeted sample and at our disposal we have a selection of sampling materials the testing of which gives a more realistic and long-term toxicological profile. The very introduction of efficient residue monitoring will decrease uncritical *D. gallinae* control.

IV. EGG PRODUCERS NEED TO:

1. Get quality information from institutions of veterinary medicine;
 2. Carefully choose the type of cage and equipment;
 3. Adhere to poultry housing downtime period;
 4. Provide short and long-term coordination of their procedures with those that enable the achievement of a highly efficient suppression and, in the long run also a permanent solution on farms.
 5. Support different pricing for uninfested and infested rearing flocks.
 6. Use their associations to promote uninfested flocks and productions where eradication has been achieved.
 7. Connect horizontally and vertically in the purpose of conducting a more rational and efficient systematic control program.
- Designers of cages and equipment need to pay due attention to their construction and solutions in order to make the environment in poultry houses less favorable for infestation and more favorable for red poultry mite control.
 - Poultry specialists need to ensure that there is adequate length of poultry housing downtime and that coordinated technology is implemented in the production process. A precondition for a successful realization of the program is organization. This common problem of poultry industry worldwide ought to be tackled through international cooperation and operability which has the capacity to actively help and supervise the improvements of *D. gallinae* control in poultry industry practice.

V. CONCLUSION

The Fipronil affair should be seen as an important opportunity to use the attention of poultry producers and scientific community to initiate a thorough change in the approach to red poultry mite control, thus creating the conditions for the elimination of the cause and consequences of this problem.

REFERENCES

- [1] O.A.E. Sparagano, A. Pavličević, T.Murano, A. Camarda, H.Sahibi, O. Kilpinen, M. Mul, M., R.van Emous, S. le Bouquin, K.Hoel and M.A.Cafiero, Prevalence and key figures for the poultry red mite *Dermanyssus gallinae* infections in poultry farm systems, *Experimental and Applied Acarology*, 48, 2009, 3-10.
- [2] O.Kilpinen, A.Roepstorff, A. Permin, G.Nørgaard-Nielsen, L.G. Lawson and H.B. Simonsen, Influence of *Dermanyssus gallinae* and *Ascaris galli* infections on behaviour and health of laying hens (*Gallus gallus domesticus*). *British Poultry Science*, 46(1), 2005, 26-34.
- [3] D.Boffey in Brussels and K.Connolly in Berlin. *The Guardian* (2017) <https://www.theguardian.com › World › Food safety>. Monday 7 August 2017 18.27 BST.
- [4] F.F.Wang, M.Wang, F.R.Xu, D.M.Liang and B.L. Pan, Survey of prevalence and control of ectoparasites in caged poultry in China, *Veterinary Record*, 167, 2010 934-937.
- [5] A.Giangasper, M.Marangi, L.Bonassisa, A.Camarda, M.Cafiero and O.A.E. Sparagano, Controllo chimico di *Dermanyssus gallinae* e rischi correlati – Chemical control of *Dermanyssus gallinae* and related risks, *Sanità Pubblica Veterinaria*, 75, 2012, [<http://www.spvet.it/>] 1-15.

- [6] O.A.E Sparagano, D.R.George, D.W.J. Harrington and A.Giangaspero, Signification and Control of the Poultry Red Mite, *Dermanyssus gallinae*. Annual Review of Entomology, 59, 2014. 447-466.
- [7] J.S.Lehoty, R.Alan, J.Lightfield, A.Harman-Fetcho and D.J. Donoghue, Analysis of Pesticide Residues in Eggs by Direct Sample Introduction/Gas Chromatography/Tandem Mass Spectrometry, Journal of Agricultural and Food Chemistry, 49 (10), 2001, 4589–4596.
- [8] A.Giangaspero, M. Marangi, S.Pati, M.A.Cafiero, C.Camarda and O.A.E. Sparagano, Investigating the Presence of Acaricide Residues in Laying Hens Naturally Infected by the Red Mite *Dermanyssus gallinae*. Proc. 12th Asean Food Conf. BITEC Bangna, Bangkok, Thailand, 2011, 223.
- [9] M.F.Mul Monique, J.Constantianus and M. Koenraadt, Preventing introduction and spread of *Dermanyssus gallinae* in poultry facilities using the HACCP method, Experimental and Applied Acarology, 48, 2009, 167–181.
- [10] L. Sasithorn, B.Priess, N.Tansakul, H.Nau, M.Kietzmann and G. Hamscher, Penetration Studies of Propoxur and Phoxim from Eggshell into Whole Egg after Experimental Exposure and Application in Henhouses, Journal of Agricultural and Food Chemistry, 55, 2007, 6401–6405.
- [11] A.Pavličević, N.Stajković, I.Pavlović, Z.Pavlovski, A.Pižurica and S. Joksović, Conceptual approach to the control of red poultry mite in Yugoslavia, Živinarstvo XXXVI (10), 2001, 191
- [12] A.Pavlicevic, Y.Jong Ung, I.Pavlovic, M.Milanovic and T.Petrovic, Control of *Dermanyssus gallinae* and program for the control of infectious diseases - a proposal for integral health care, Abst. XIX Symposium of Epizootiologists and Epidemiologists - with International Participation - (XIX Epizootiological Days, Vršac, Serbia, 2017, 171-172
- [13] A.Pavlicevic, I.Pavlovic, N.Stajkovic and B.Pešić, Evidence for Resistance to Carbaryl in Poultry Red Mites from the Republic of Serbia and Montenegro. Animal Science and Biotechnologies, 49 (1), 2016, 222-225.
- [14] A.Pavličević, I.Pavlović, N.Stajković and A. Pižurica, Method for early detection of poultry red mites *Dermanyssus gallinae*, Abst. V Epizootiological days with international participation, Subotica, Yugoslavia, 2003, 304-305
- [15] A.Pavlicevic, I.Pavlovic and N.Stajkovic, Method for early detection of poultry red mites *Dermanyssus gallinae* (DeGeer, 1778) Biotechnology in Animal Husbandry, 23 (3-4), 2007, 119 - 127
- [16] Pavlicević Aleksandar, Pavlović Ivan, Vasić Ana, JongUng Yoon (2017) Detección temprana del ácaro rojo, Albéitar, 205, 24-26
- [17] A.Pavlicevic, S.Petricevic, I.Pavlovic, N.Stajkovic and A.Pižurica, Contribution to forensic assessment of dermanisosis (*Dermanyssosis*), Veterinarski glasnik, 57 (7-8), 2003, 517-523.
- [18] A.Pavlicevic, I.Pavlovic and M.Dotlic A contribution to information on starvation survival capacity of poultry red mite *Dermanyssus gallinae*, Lucrari Stiintifice Medicina Veterinara, 50 (9), 2007, 485-491
- [19] A.Pavlicevic, I.Pavlovic, M.Dotlic and A. Nemet, House fly *Musca domestica* like transmitter of red poultry mites *Dermanyssus gallinae*? World Poultry Science Journal 64, Supplement 1, 2008, 72-73.
- [20] I.Pavlovic, A.Pavlicevic and A. Vasić, House flies *Musca domestica* as transmitter of red poultry mite *Dermanyssus gallinae* - case report, Agricultural Science Research Journal 6(5), 2016 117-119.
- [21] A.Pavličević, I. Pavlović, N.Stajkovic and A. Pižurica, Program control of red chicken mites (*Dermanyssus gallinae*) instruction to producers, Živinarstvo XXXVIII (3-4), 2003, 11-15.
- [22] A.Pavličević and I. Pavlović, Did the EU miss an opportunity for red mite control in poultry ? Poultry News, 31 May 2016, <http://www.thepoultrysite.com/poultrynews/37107/did-the-eu-miss-an-opportunity-for-red-mite-control-in-poultry/>
- [23] A.Pavličević and I. Pavlović, How do Cages Influence Red Mite Control in Layers? Poultry News, 07 July 2016, <http://www.thepoultrysite.com/poultrynews/37176/how-do-cages-influence-red-mite-control-in-layers/>